The Projects of...

Prototype

Joe Grand aka KINGPIN

Zoz aka

DEFCON 17
Prototype This!

- Engineering entertainment program on Discovery Channel
- Four guys building prototypes of crazy things
- Try to follow the "true" design process
- Premiered October 2008 (US), ~February 2009 (World)
- Thirteen episodes
- ~1 million households/episode
- [www.discovery.com/prototypethis](http://www.discovery.com/prototypethis)
electrical engineer. hardware hacker. daddy.
robotics. software programming. mad scientist. mit.
Mike North

materials scientist. mechanical engineer. ucsb.
special effects. machinist. fabricator.
joe andreas. kevin binkert. steve lassovsky. flaming lotus girls. nemo gould. diana coopersmith. many, many more.
We built stuff like this...
We built stuff like this...
We built stuff like this...
With not a lot of this...

(Contrary to popular belief...)
Challenges

- TV is nothing like how it really happens in real life
  - Don't believe the hype
- Most producers/editors/execs were not technical and didn't care to be
  - Were only interested in the final result
- Did not understand the complexity of the tasks
  - Assumed everything was easy
- Wanted unrealistic projects that had never been done before built in two weeks or less
  - Ex.: X-ray glasses, personal force field
- How to make engineering sexy?
Traffic Busting Truck

- Omnidirectional Wheels
- Autonomous Parking
- Drive/Park Over Traffic
- ~4 weeks
Traffic Busting Truck

- BASIC Stamp 2p40
- RF Keyfob
- Wireless PS2 Controller for manual couch/truck control
- Solenoid/Hydraulic Valve control via MOSFET
- DS1867 Digital Potentiometers for Joystick Emulation for omnidirectional wheel control
- Serial port I/F to communicate w/ Zoz's autonomous control S/W
Traffic Busting Truck Sensors

- IR, US: single range
- Stereo: 640x480 RGBD map
- IR: detect suitable gaps between parked cars
- Stereo: parallel alignment of vehicle at parking distance
- Ultrasonic: curb detection for park slide completion

Parallax PING))) ultrasonic rangefinder

Sharp GP2 infrared rangefinder

Videre Design STOC stereo camera
Fire Fighter PyroPack

- High-tech FF pack & headset
- ~2 weeks

![Image of a firefighter using the PyroPack](image1)

![Image of the PyroPack from behind](image2)

![Image of a firefighter extinguishing a fire with the PyroPack](image3)
Fire Fighter PyroPack

Sexy 3-D Body Scans!@#

Nerds Gone Wild!
Fire Fighter PyroPack

• Pack "printed" by Forecast 3D, San Diego
Fire Fighter PyroPack

- Breathing air tank
- Primary regulator
- Digital pressure transmitter
- Dry-chem
- Makita 18V drill battery
- Circuit board

- Thermal imaging camera
- Heads-up microdisplay
Fire Fighter PyroPack

- BASIC Stamp 2sx
- Parallax RFID Reader
- Memsic 2125 Accelerometer
- BOB-4-H On-Screen Display Module
- eMagin Reference Board

- Thermal image
- Temperature display
- % of remaining air
- Firefighter identification
Virtual Sea Adventure

- Underwater Projection
- Remotely Controlled Seabotix ROV via 1000ft. Ethernet
- Magnetic Thumb Control
- Live HD Video Feed
- ~2 weeks
Virtual Sea Adventure

• BASIC Stamp 2
• Melexis MLX90333 3-D Magnetic Position Sensors
• ADC0834 Analog-to-Digital ICs
• Lantronix XPORT Serial-to-Ethernet Interface (sends control data inside UDP Broadcast packet)
Virtual Sea Adventure

Oh my God, that is so weird!
Waterslide Simulator

- Fully computer controlled motion simulator
- Real water!@#
- Over 30 feet tall
- 5 weeks (build/program/test)
- CAD/FEA predesign by Acorn
Waterslide Simulator

- 3D rendering of waterslide by Splashtacular
- 3600 ft slide – too much for physics sim package!
- 6-axis camera flythrough
- 3DOF output mapping: lift, tilt, rotation
Waterslide Simulator

- Heavy metal!
- RMC150 embedded motion controller
- 6 linear axes (2 lift, 4 tilt), 1 rotary
- UDP direct write access to RMC150 registers
Waterslide Simulator Control

- 3DOF B-Spline interpolated axis data downloaded to RMC
- Controller/visualizer (OS X Java) UDP commands RMC
- RMCTools (Windows in VM) monitors & tweaks control loops
- Secondary visualizers (OS X Java) synced via UDP
Flying Lifeguard

- Lifesaving equipment for the "beach of the future"
- Autonomous airplane with lifejacket delivery
- Short-range auto-positioning pneumatic cannon to shoot lifejacket into surf zone
- Wristband transmitter worn by swimmer sends GPS coordinates
Flying Lifeguard

- BASIC Stamp 2
- Aerocomm AC4490 900MHz RF Transceiver
- Parallax GPS Receiver Module
- Enclosure made with Z-Corp 3D printer
Flying Lifeguard

- BASIC Stamp 2sx
- Micromega uM FPU Floating Point Coprocessor
- Aerocomm AC4490 900MHz RF Transceiver
- Parallax GPS Receiver Module
- Anemometer (Wind Speed & Direction)
- Miniature OLED
- Lantronix XPORT Serial-to-Ethernet Interface
  (data sent to Zoz's PC for real calculations)
Flying Lifeguard

- Micropilot MP2028 UAV & HORIZON ground control software
- Rocket launch via sled mechanism
- Some custom plug-ins for more accurate GPS tracking
- Servo-controlled payload deployment
• Cannon firing solution
  • Map lat/longs to WGS-84 ellipsoid
  • Correct for magnetic/true North
  • Compute base chamber pressure for range
  • Anemometer data to correct for wind speed and direction

• UAV launch procedure
  • Load lat/longs into HORIZON
  • Set up approach run with waypoints
  • GPS only samples @ 1 Hz!
  • Trigger drop servo within target range predictor
MORE DETAILS AT:
www.grandideastudio.com/prototype-this/